



Local knowledge of tree cover change, natural resource conservation and livelihoods in the Blue Nile Basin, Ethiopia

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Outline

- Research Framework CPWF & NBDC
- About Local Ecological Knowledge
- Acquiring Local Ecological Knowledge of Trees in the Blue Nile Basin

Challenge Program on Water and Food

- Initiative of CGIAR;
- Aims poverty reduction through better management of water and sustainable agriculture;
- Divided in 2 phases:
 - ✓ *Phase 1 – explore water and food issues using different approaches;*
 - ✓ *Phase 2 – research based on lessons learned.*

See: <http://www.waterandfood.org/page/CPWF-Research>



Nile Basin Development Challenge

- Aims to improve resilience of rural livelihoods in the Ethiopian highlands through a watershed approach to rainwater management;
- Partnership between:



See: <http://www.waterandfood.org/page/Nile/type:basin>



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Local Ecological Knowledge:

What is it?

Knowledge held by farmers and natural resource users as a result of their daily interactions with their natural environment, based primarily experience and observation.

This knowledge continually evolves, responding to changing environmental and societal conditions (Davis & Wagner, 2003).

Local Ecological Knowledge:

Why is it useful?

“Farmers have been developing agricultural systems, domesticating animals, breeding new crop varieties and constructing irrigation systems throughout the centuries without the aid of formalized scientific approaches and agricultural extension systems. In order to develop sustainable strategies it is important to take account of, and learn from, what local people already know and do, and to build on this.” (Warbuton & Martin, 1999).

Local Ecological Knowledge:

Why is it useful?

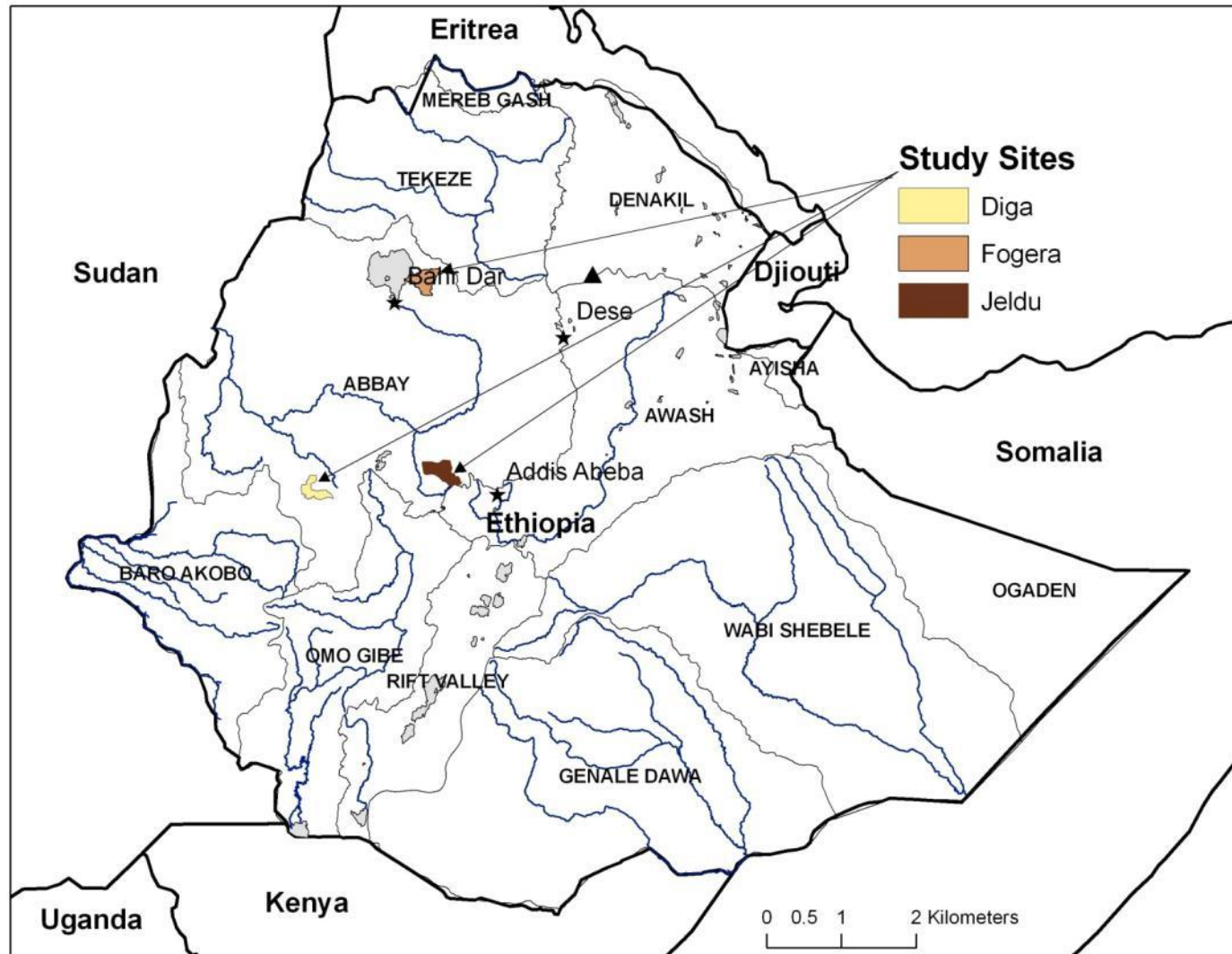
Increasing awareness of the importance of local knowledge in resolving natural resource management issues:

“Local knowledge and practices should be recognised in developing initiatives aimed at sustaining and improving the livelihoods of farming communities and the environment.” (Dixon *et al.*, 2001).

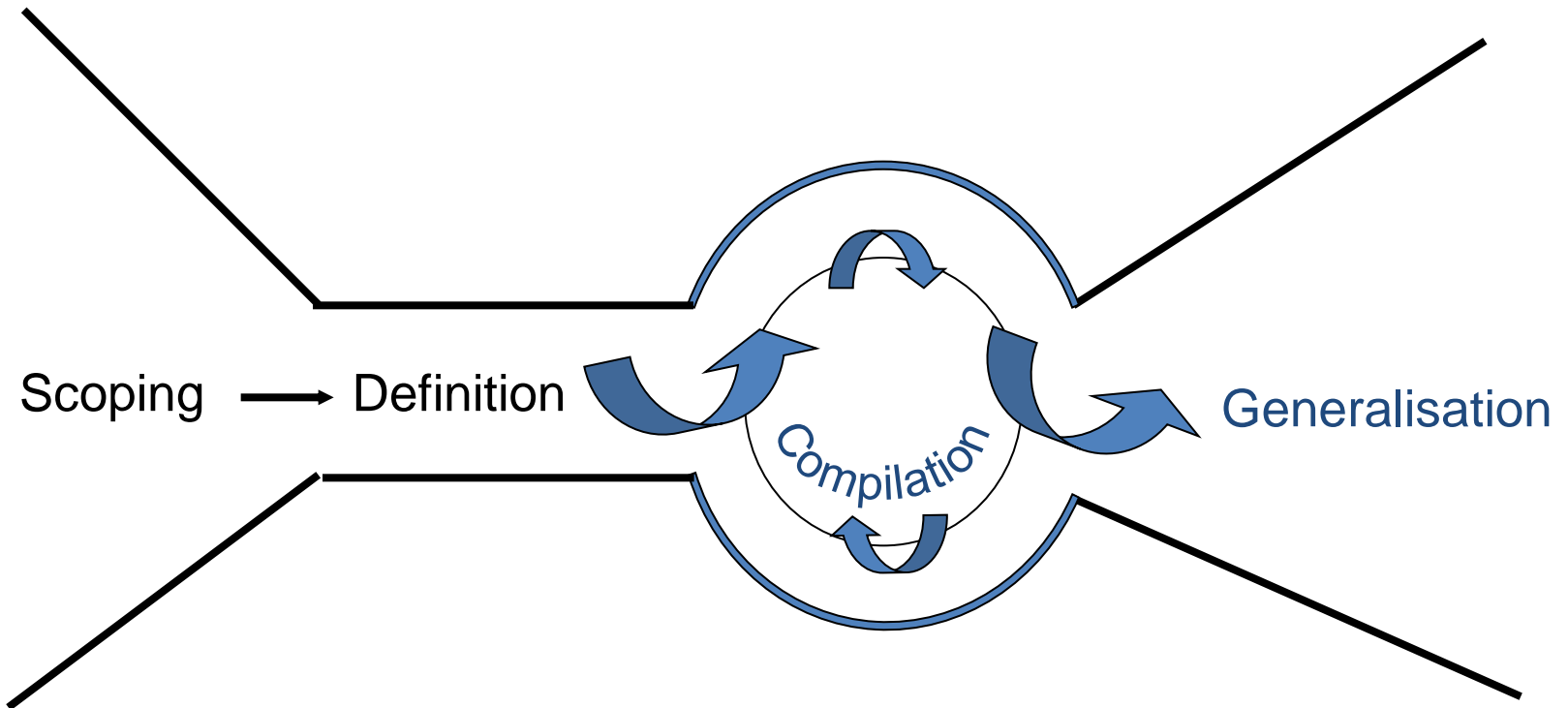
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Study Areas



Acquisition strategy



Knowledge Compilation

Agroecological Knowledge Toolkit

- Gathers LEK in a knowledge based system;
- Breaks knowledge in short statements;
- Associated taxonomies or hierarchies of terms;
- Connections explored as diagrams;
- Helps to evaluate and explore complex knowledge domains.

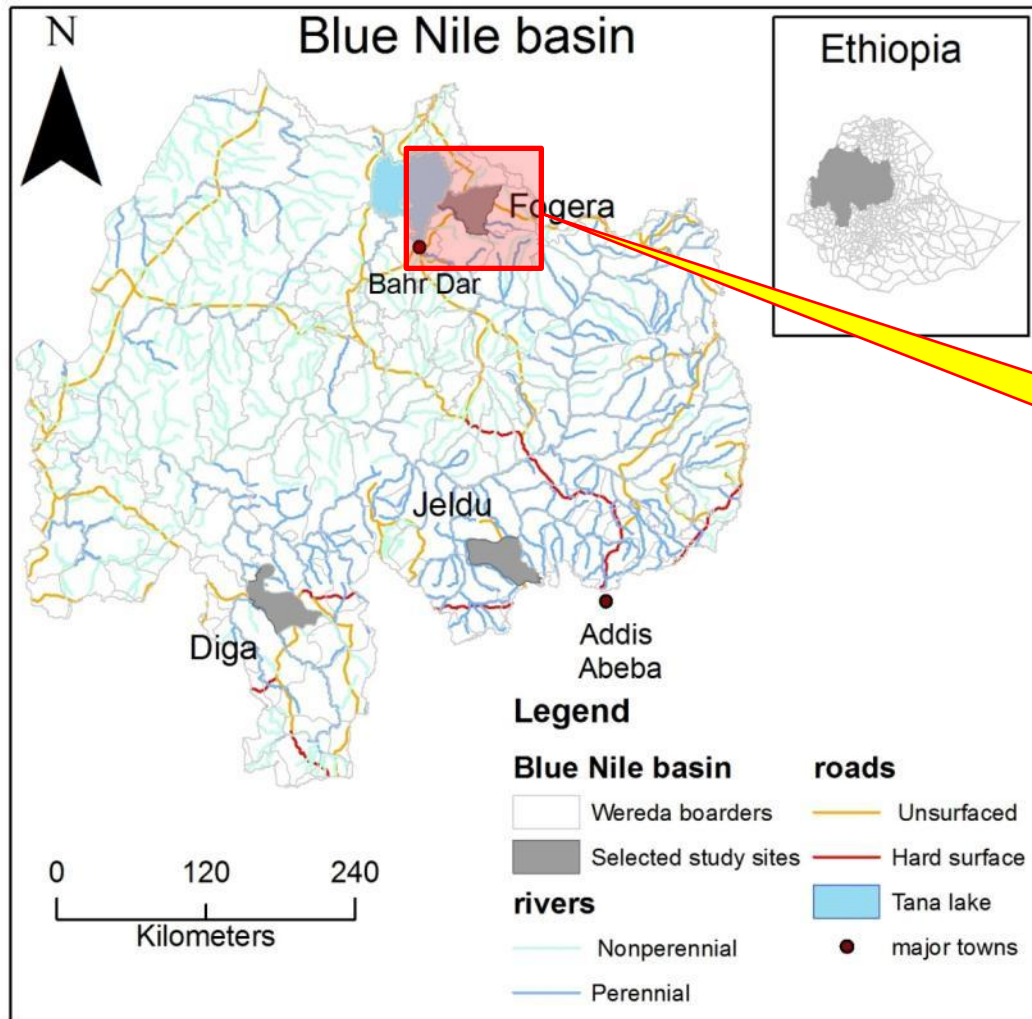
Research questions

- Throughout the landscape, what are the drivers of tree cover change (planting and removal)?
- What is/could be the impact of the tree cover change on the soil and water systems at a landscape scale (both quantitative and qualitative aspects)?
- How all of these changes are/could be in turn impacting people's livelihoods (farming systems, food security, energy supply)?



Fogera District

Study area



Sampling strategy

Agro-ecological zones

Denomination	Altitude range (masl)	Dominant crops and livestock
Plains	1700-1800	Rice , finger millet, noug, vegetables, pulses, cattle, sheep.
Midlands	1900-2000	Cereals (maize, teff, finger millet), oil crops, vegetables, apiculture, cattle, goats.
Highlands	2000-2400	

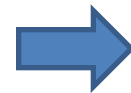
Sampling strategy

Study sites

The NBDC is currently being implemented within 5 kebeles across the District.

→ 3 of them were selected for the LEK acquisition considering:

- The elevation gradient – to try and capture the change in LEK according to the agro-ecological context, as well as the upstream-downstream relationships;
- The accessibility.



Sampling strategy

Semi-structured interviews

Stratification variables were chosen in consultation with extension workers intervening in the area:

- Gender;
- Age;
- Wealth.

Willingness was the first criterion when selecting the respondents.

Sampling strategy

Summary of the farmers interviewed

	Site 1 (Alem Ber)	Site 2 (Diba)	Site 3 (Kokit)	TOTAL
Men	7	8	7	22
Women	2	1	2	5
TOTAL	9	9	9	27

Sampling strategy

- **Focus group discussions** : one in each site;
- **Feed back session** : one in the mid-land site;
- ➔ Participants (6 to 8) selected on a voluntary basis.



Main findings

A) Sites 1 & 2 (Mid- and Highlands)



Alem Ber Zuria Kebele



Dibasifatira Kebele

Main findings

A) Sites 1 & 2 (Mid- and Highlands)

- Historically **mainly forested**;
- Tree cover has been decreasing overtime as well as tree species diversity;

Due to the combination of several drivers:

- Increase in population
- Short term view/convenience
- Low sense of ownership/level of control



Main findings

Main trees found on farms and their uses

Scientific name	ORIGIN	Construction	Firewood	Charcoal	Timber	Fodder	Fruit	Farming	Medicine	Compost	Riparian	Field boundary hedges	Settlement hedges	Cropland fences	Livestock shading	Soil erosion mitigation
<i>Acacia abyssinica</i> & <i>A. tortilis</i>	I		x			x		x			x			x	x	x
<i>Brucea antidysenterica</i>				x					x							
<i>Capparis tomentosa</i>	I					x			x					x		
<i>Carica papaya</i>	E						x									
<i>Cordia africana</i>	I		x		x	x									x	
<i>Croton macrostachys</i>	I		x					x	x	x	x				x	x
<i>Entada abyssinica</i>	I		x	x												
<i>Eucalyptus camaldulensis</i>	E	x	x					x			x	x	x		x	x
<i>Ficus sycomorus</i>	I	x		x	x											
<i>Grevillea robusta</i>	E		x	x												
<i>Humulus sp.</i>																
<i>Juniperus procera</i>	I		x		x				x							
<i>Mangifera indica</i>	E						x									
<i>Maytenus arbutifolia</i>	I	x				x					x			x		
<i>Olea africana</i>	I	x	x	x		x		x								
<i>Psidium guajava</i>	E						x									
<i>Rhamnus prinoides</i>	I		x	x												
<i>Sesbania sesban</i>	I	x	x			x				x						x
<i>Syzigium guineense</i>		x		x							x					

Main findings

❖ On farmlands

Indigenous tree species are almost only naturally regenerated and largely unmanaged afterwards

They tend to decrease due to:

- Overexploitation (fencing, fodder, firewood);
- Degradation by livestock **on grasslands**;
- Intentional removal **on croplands**;

In recent years **Wanza** (*Cordia africana*) has tended to increase due to the increase in timber demand.

Main findings

❖ On farmlands

Fruit trees are planted close to the settlements to prevent wildlife and livestock eating the fruits as well as theft by humans.

- As tree lines on field boundaries;
- As single trees on croplands;
- Fruit gardens (uncommon).

Main findings

❖ On farmlands

Eucalyptus is by far the main species to be intentionally planted due to:

- Its high suitability for house construction and selling on local markets;
- Its fast growing rate and ability to restock;
- Its high firewood value;
- Its low need for management.

Main findings

❖ On farmlands

Farmers are ALL aware of the potential disadvantages of **Eucalyptus** for the soils:

- Acidification;
- High competition for water and nutrients;
- Low degradability of the leaves that cover the soil.



Main findings

❖ On farmlands

Farmers minimise the negative effects of **Eucalyptus** on the soils by planting it as:

- Woodlots when land availability is sufficient;
- Boundary hedges when land is scarce.

They also remove the fallen leaves from the soil.



Main findings

❖ On river banks

Tree cover is decreasing on perennial river banks and almost inexistent on seasonal river banks...


... For several reasons:

- Falling down due to high level of river bank erosion;
- Degradation by livestock;
- Little planting due to:
 - ✓ *Lack of awareness/conviction;*
 - ✓ *Lack of common agreement due to ownership systems.*



Main findings

Impacts of the change in tree cover

- Erosion (sloped areas and river banks);
- Lack of rainfall; 
- Higher exposure to wind and sun of livestock;
- Decrease in wildlife populations;
- Lack of tree products (fodder, charcoal);
- Decrease in honey production.

Main findings

Due to recent extension work/awareness raising things seem to be slowly improving:

- The over exploitation of the common tree resource tend to decrease;
- Private owned trees are increasing.



BUT...

- Although native trees are being promoted they are still facing a lack of interest from farmers.

→ Tree diversity remains very low!

Main findings

A) Site 3 (Plains)




Tihua Ena Kokit Kebele

Main findings

A) Site 3 (Plains)

- Historically **community grasslands**;
- Increase in tree cover overtime but decrease in species diversity.

Due to the combination of several drivers:

- Increase in population;
- Increase in frequency of summer flooding. 

Main findings

- **Eucalyptus** is even more dominant there due to its tolerance to waterlogging;
- Among native trees, *Acacia* spp. are the only ones to withstand waterlogging;
- Most fruit trees are dying as well;
- River banks (mainly perennial) are often more planted (*Eucalyptus*, *Acacia* spp., *Calpurnia subdecandra*) and reinforced with “dykes”.

Summary

Farmers have a **reasonably detailed understanding** of the drivers of tree cover change and the impacts of this latter on their environments and livelihoods.

BUT most of them tend to adopt the most convenient/financially interesting practices for **TODAY** without thinking about the potential long term consequences.

→ This appears to be both **contextual** and **cultural**.

Summary

Most farmers see **Eucalyptus** as THE most useful tree, due to its large diversity of uses and its high income generating potential.

*“Eucalyptus is like fire and water: potentially harmful and tricky to manage...
... but essential to life.”*

Very few farmers appear to perceive the little tree diversity as a real problem!

What can we do?

- Raising awareness about ecosystem services of trees and benefit of tree species diversity;
- Making farmers believe in what they say! And give them the willingness/possibility to think about the future and 'invest' in trees;
- Supporting the design and coordination of community-driven actions;
- Relying on progressive farmers;
- Promoting species that could “balance” Eucalyptus with similar characteristics and less negative impacts.

References

- Davis, A. & Wagner, J. (2003). Who knows? On the importance of identifying “experts” when researching local ecological knowledge. *Hum Ecol* 31:463–489.
- Dixon, H.J., Doores, J.W., Joshi, L. & Sinclair, F.L. (2001). Agroecological Knowledge Toolkit For Windows: Methodological Guidelines, Computer Software And Manual For AKT5. School of Agricultural and Forest Sciences, University of Wales, Bangor, UK.
- Warburton, H. and Martin, A. (1999). Local people’s knowledge in natural resources research. *Socio-economic Methodologies for Natural Resources Research*. Chatham , UK : Natural Resources Institute.

A man wearing a blue and white striped shirt and dark pants is wading through a wide, shallow river with muddy, brown water. The riverbank in the background is covered with grey rocks and green vegetation. The text is overlaid on the image.

Thank you for your attention!

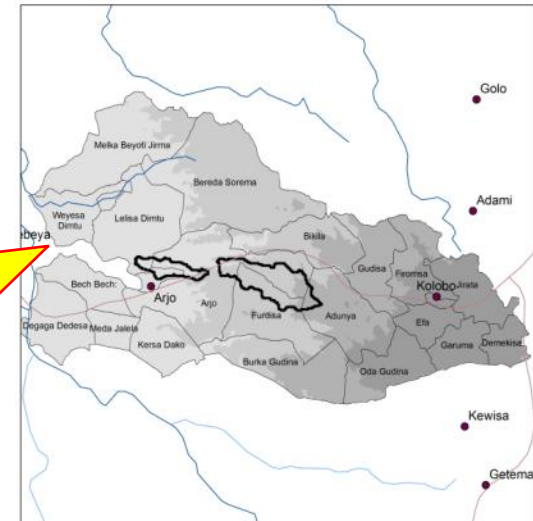
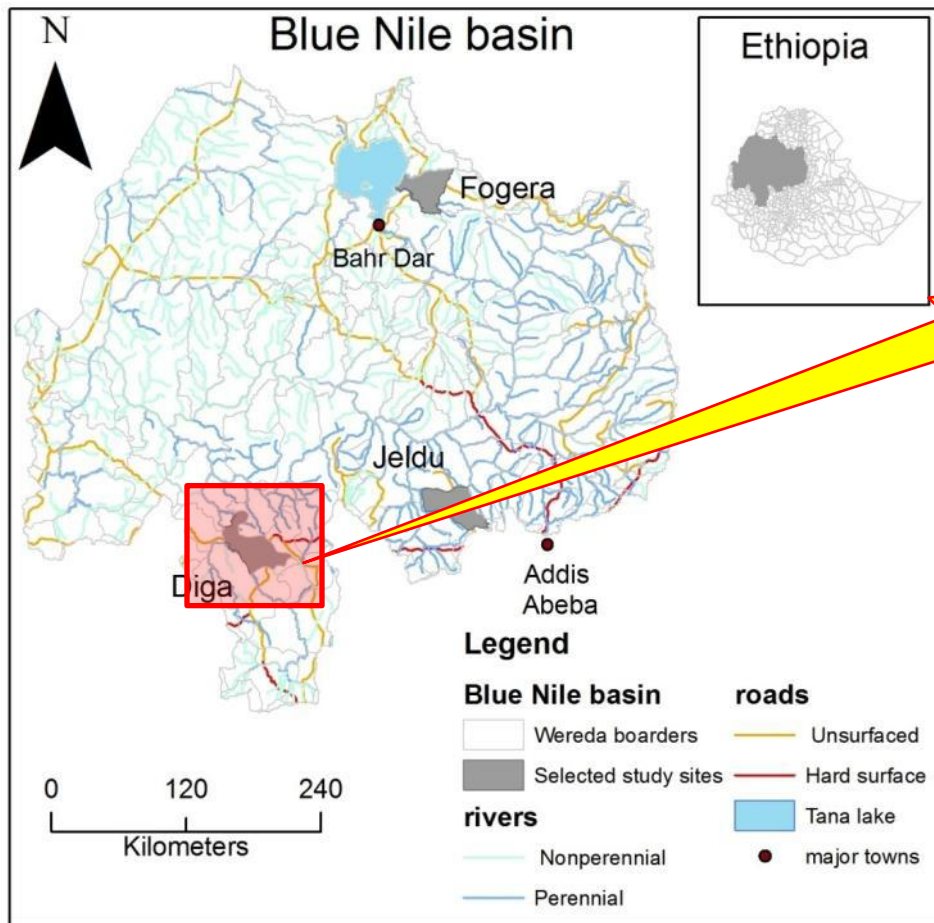
Any questions, comments,
suggestions?

*"Anyone who can solve the problems of water will be
worthy of two Nobel Prizes - one for Peace
and one for Science." (John F. Kennedy).*

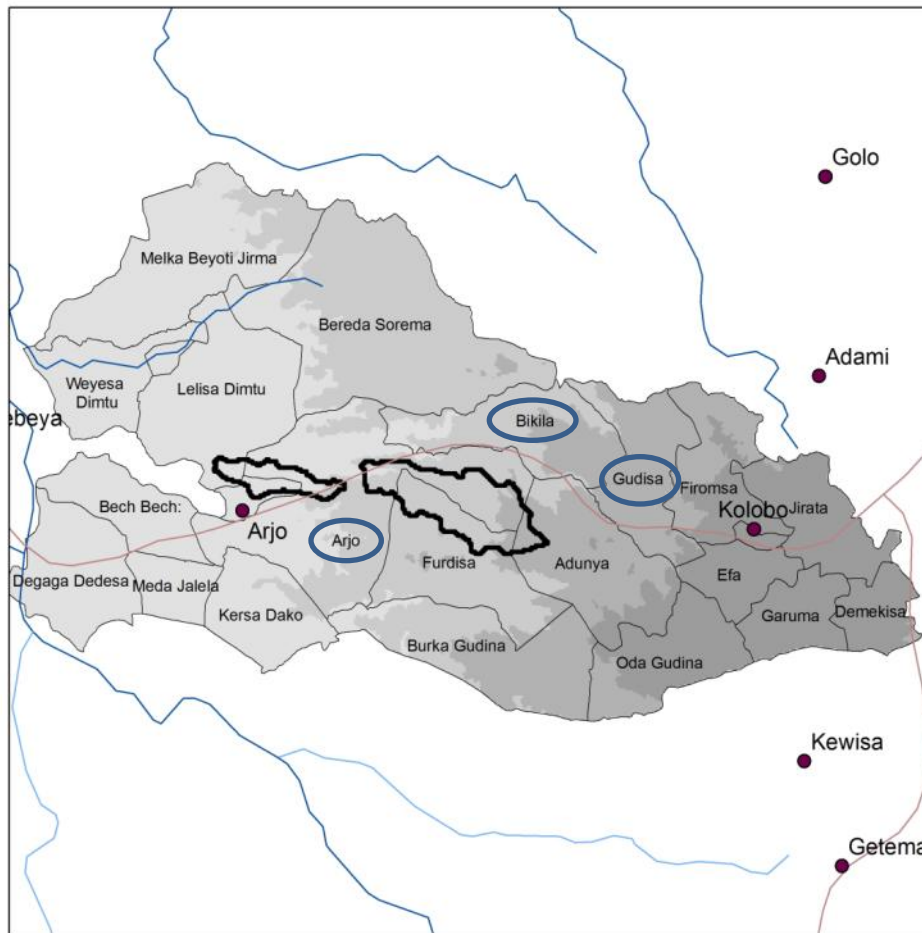
Diga District



Study Area



Diga Woreda



Midlands

Rainfall :1700 – 1800mm

Average Temperature: 17°C

Lowlands

Rainfall :1600 – 1700mm

Average Temperature: 22°C

Legend

Kebele boarders	Rivers	Elevation
towns	type	in meters
Roads	Perennial	1.139 - 1.379
type	Nonperennial	1.380 - 1.620
Hard surface		1.621 - 1.860
Non hard surface		1.861 - 2.101
chekorsa at diga		2.102 - 2.341
dapo at diga		

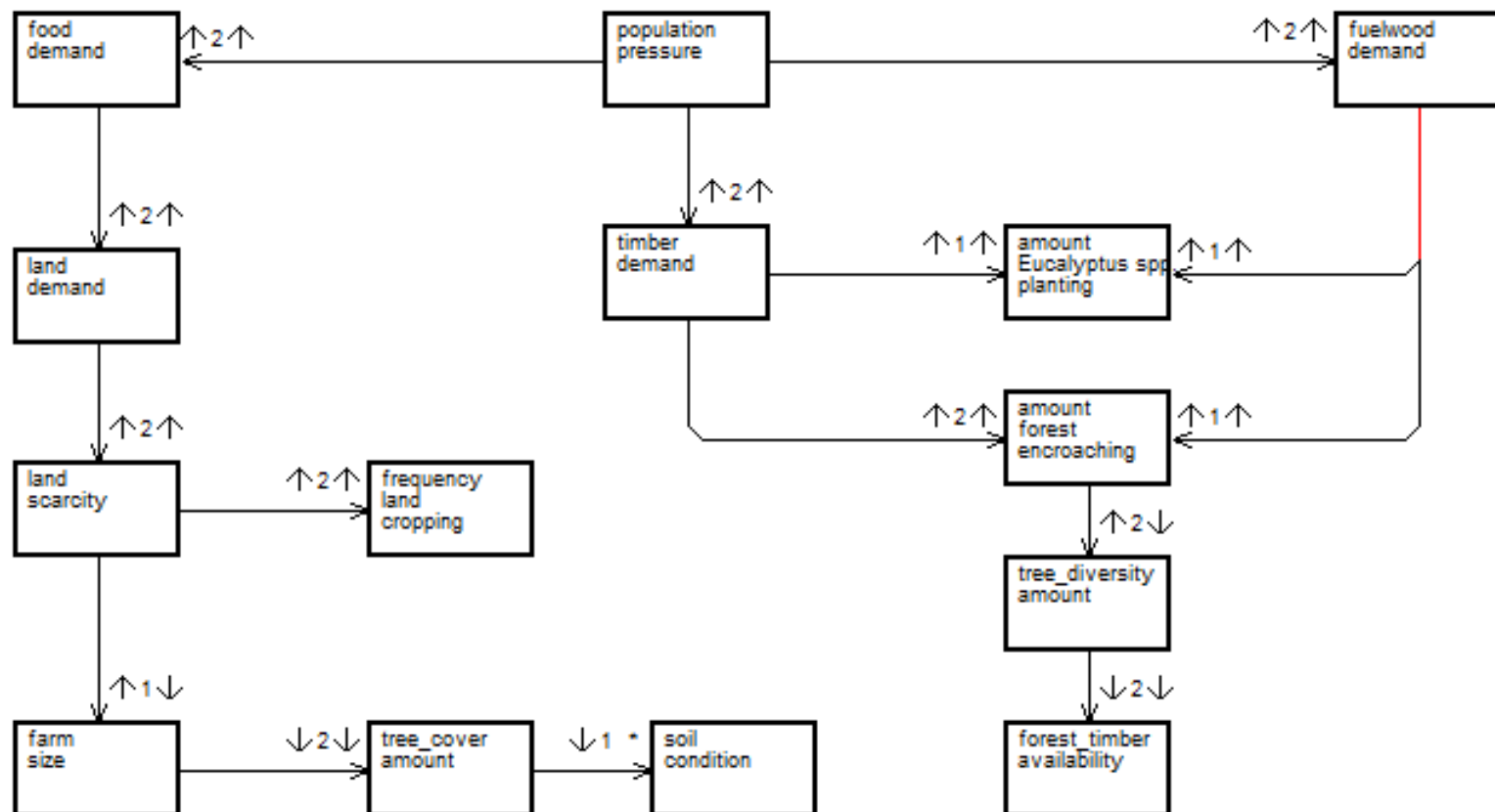
Sampling Strategy

Semi-structured interviews	
Farmers	24
Paid labourers	5
Extension workers	3
Total 1 st Interviews	32
Second Interviews	6
TOTAL	38
Transect walk	
Gudisa (1), Bikila (1), Arjo (1)	3
Feedback Sessions	
Arjo	1

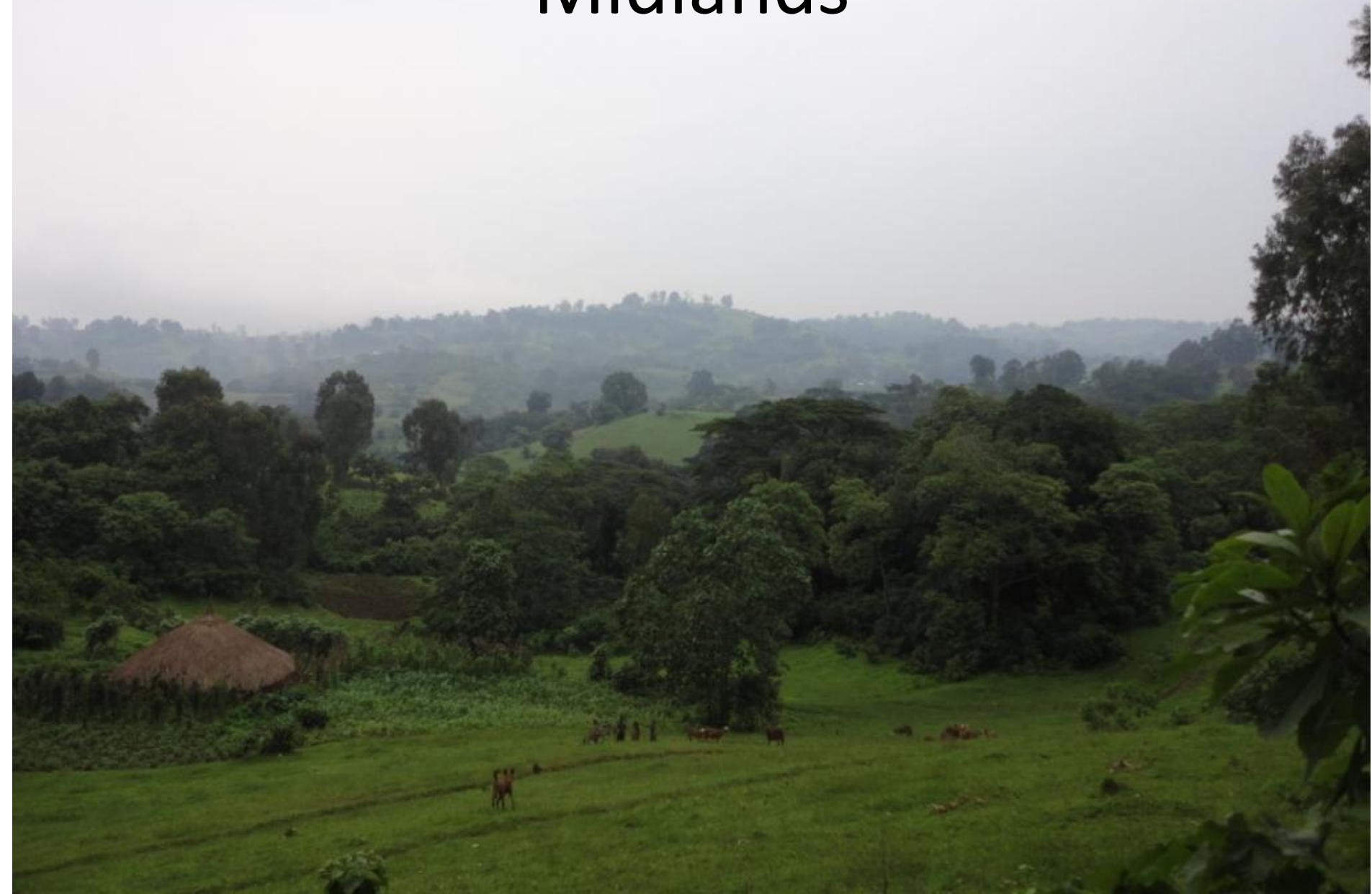
Gender	
Male	26
Female	6
Total	32

Age groups	
< 35	10
35 – 60	17
> 60	5
Total	32

Drivers of Tree Cover Change



Midlands



Main Crops



Lowlands



Main Crops



Main reasons for tree planting according to farmers

- Mitigating soil erosion;
- Restoring soil fertility;
- Increasing timber and fuelwood availability;
- Generating income;
- Coffee shading.



Decreasing soil erosion



Species	Midlands	Lowlands	Location
<i>Croton macrostachyus</i>	x	x	field border, top of slope, lower edge
<i>Eucalyptus globulus</i>		x	top of slope
<i>Vernonia amygdalina</i>	x	x	field border, top of slope
<i>Pennisetum purpureum</i>	x	x	field border, top of slope
<i>Musa spp</i>	x	x	field border, top of slope, lower edge
<i>Phalaris arundinacea</i>		x	field border
<i>Myrica salicifolia</i>	x	x	field border, top of slope
<i>Chrysopogon zizanioides</i>	x	x	field border, top of slope, adjacent to other structures (Arjo)



Restoring Soil Fertility



Species	Midlands	Lowlands	Feature
<i>Maesa lanceolata</i>	x		Mulch
<i>Croton macrostachyus</i>	x	x	Mulch
<i>Vernonia amygdalina</i>	x	x	Mulch
<i>Hagenia abyssinica</i>	x		Mulch
<i>Mangifera indica</i>		x	Mulch
<i>Polyscias fulva</i>	x		Mulch and green manure
<i>Ricinus communis</i>		x	Organic manure (fruits)
<i>Myrica salicifolia</i>	x	x	Mulch
<i>Cordia africana</i>	x	x	Mulch
<i>Erythrina abyssinica</i>	x		Mulch and nitrogen fixation

Increasing Timber Availability



Species	Midlands	Lowlands	Feature
<i>Syzygium guineense</i>	x	x	Planted
<i>Eucalyptus globulus</i>	x	x	Planted
<i>Fagaropsis angolensis</i>		x	Planted
<i>Aningeria adolfi-friedericii</i>		x	Forested areas
<i>Juniperus procera</i>		x	Planted
<i>Cordia africana</i>	x	x	Pruned branches

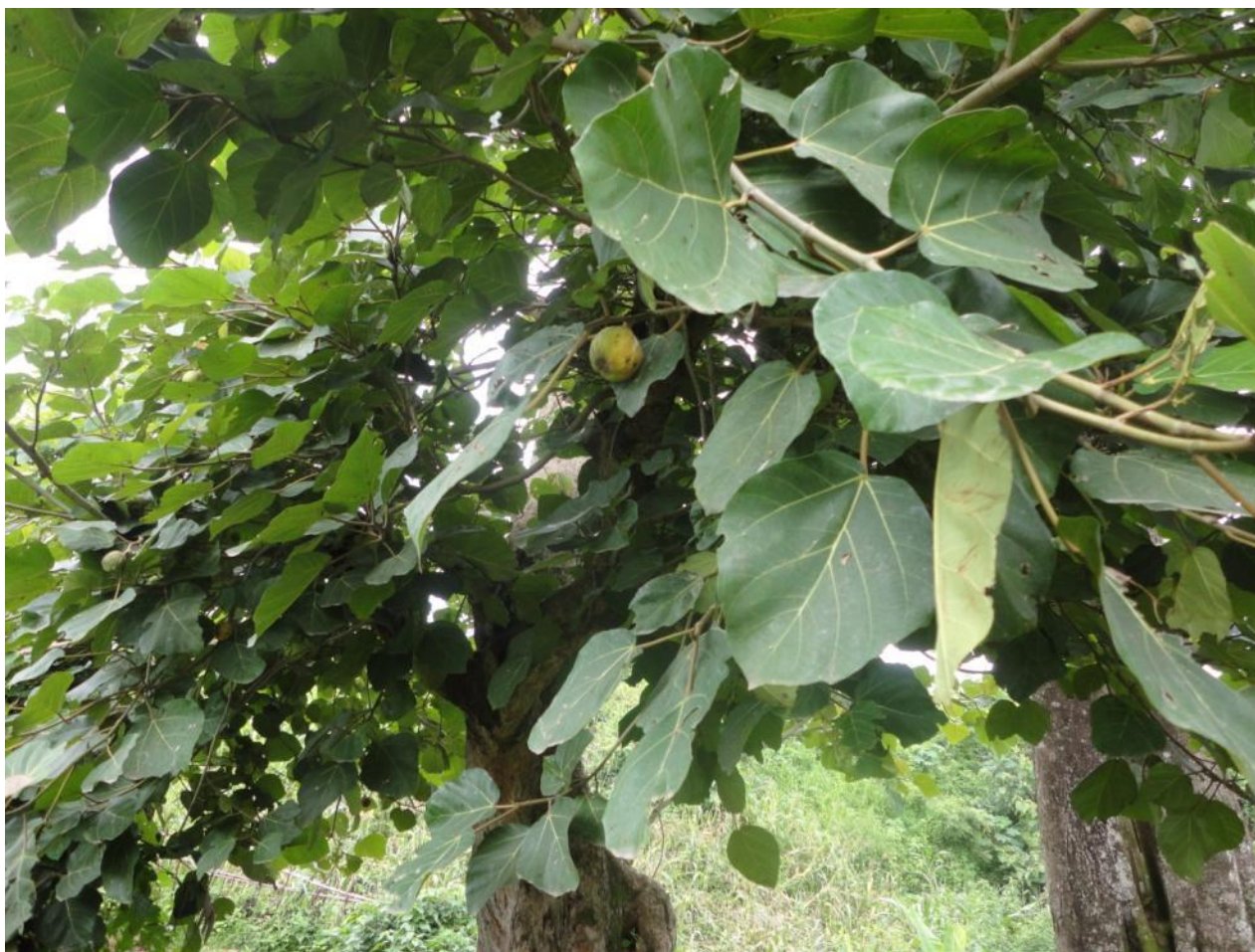


Increasing Fuelwood Availability



Species	Midlands	Lowlands	Feature
<i>Acacia sieberiana</i>	x		Forested areas
<i>Albizia schimperiana</i>	x		Forested areas, planted
<i>Bersama abyssinica</i>	x		Forested areas, planted
<i>Buddleja polystachya</i>	x		Forested areas
<i>Cordia africana</i>	x		Planted (pruned branches)
<i>Croton macrostachyus</i>	x	x	Planted
<i>Erythrina abyssinica</i>	x		Planted
<i>Eucalyptus globulus</i>	x		Planted
<i>Ficus sur</i>	x	x	Forested areas
<i>Ficus sycomorus</i>	x		Forested areas
<i>Hagenia abyssinica</i>	x		Forested areas
<i>Jacaranda mimosifolia</i>	x		Planted
<i>Juniperus procera</i>		x	Planted
<i>Maesa lanceolata</i>	x		Forested areas
<i>Myrica salicifolia</i>	x	x	Forested areas
<i>Podocarpus falcatus</i>	x		Forested areas
<i>Salix mucronata</i>		x	Forested areas
<i>Sesbania sesban</i>	x		Planted
<i>Stereospermum kunthianum</i>		x	Forested areas
<i>Syzygium guineense</i>	x		Forested areas, planted
<i>Teclea nobilis</i>	x		Forested areas
<i>Vernonia amygdalina</i>		x	Planted

Generating Income



Species	Midlands	Lowlands	Feature
<i>Mangifera indica</i>	x	x	Fruits
<i>Coffea arabica</i>	x	x	Commodity crop
<i>Musa spp</i>	x	x	Fruits
<i>Eucalyptus globulus</i>	x	x	Timber, fuelwood
<i>Persea americana</i>		x	Fruits
<i>Carica papaya</i>		x	Fruits
<i>Ananas comosus</i>		x	Fruits
<i>Ficus sycomorus</i>		x	Fruits
<i>Citrus sinensis</i>		x	Fruits
<i>Citrus limon</i>		x	Fruits
<i>Cordia africana</i>	x	x	Timber

Coffee Shading



Species	Midlands	Lowlands	Feature
<i>Acacia sieberiana</i>	x		Small leaves
<i>Albizia grandibracteata</i>	x		Nitrogen fixation
<i>Albizia schimperiana</i>	x		Small leaves, nitrogen fixation
<i>Cordia africana</i>	x		Medium leaves, leaves improve soil fertility
<i>Croton macrostachyus</i>	x	x	Easily grown, leaves improve soil fertility
<i>Ficus sur</i>		x	Tree height
<i>Ficus sycomorus</i>		x	Sacred tree, large crown
<i>Maytenus senegalensis</i>	x		coffee seedling shading
<i>Millettia ferruginea</i>	x		Tree height
<i>Myrica salicifolia</i>	x		Coffee seedling shading
<i>Ricinus communis</i>	x	x	Coffee seedling shading
<i>Vernonia amygdalina</i>	x		Coffee seedling shading

Other Reasons for Tree Planting

- Improve weather condition;
- Fodder;
- Increase honey production.



Constraints for Tree Planting

- Attract wild animals;
- Competition for water, light and nutrients;
- Termites;
- Lack of land and secure tenancy;
- Lack of knowledge about where and why plant trees;
- Lack of money to buy seedlings.

Ideas for Future Interventions

- Implementation of irrigation systems and rain harvest;
- Improve extension workers support to farmers;
- Promote indigenous trees to replace eucalyptus.



Thank you!

